In the Claims:

1. (PREVIOUSLY PRESENTED) A chemical process system comprising:

a pressure vessel including a wall;

a first microchannel module mounted within the pressure vessel and including at least two sets of isolated microchannels;

a reactant conduit extending through the pressure vessel wall and into communication with a first set of isolated microchannels of the first microchannel module for conveying steam and a hydrocarbon to the first set of isolated microchannels;

a fuel conduit extending through the pressure vessel wall and into communication with a second set of isolated microchannels of the first microchannel module;

an oxygen source conduit extending through the pressure vessel wall and into communication with the second set of isolated microchannels of the first microchannel module;

a product conduit in communication with the first set of isolated microchannels and extending through the pressure vessel wall for conveying products from the first set of isolated microchannels;

an exhaust conduit in communication with the second set of isolated microchannels and extending through the pressure vessel wall for conveying exhaust from the second set of isolated microchannels;

wherein the first set of isolated microchannels is in thermal communication with the second set of isolated microchannels; and

wherein the first set of isolated microchannels houses a steam reformation catalyst.

2-6. (CANCELLED)

7. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, wherein the first microchannel module is at least one of cooled and heated at least in part by a compressive medium present within the pressure vessel and around the first microchannel module.

8. (PREVIOUSLY PRESENTED) The chemical process system of claim 7, wherein the compressive medium includes at least one of helium, neon, argon, krypton, xenon, and nitrogen.

9. (PREVIOUSLY PRESENTED) The chemical process system of claim 7, wherein the compressive medium includes water.

10. (CANCELLED)

11. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, wherein the catalyst comprises at least one of a catalytic lining, a catalytic pellet, and a catalytic insert.

12. (PREVIOUSLY PRESENTED) The chemical process system of claim 7, wherein the compressive medium within the pressure vessel is adapted to be in fluid communication with at least one of a pump and a compressor.

13. (PREVIOUSLY PRESENTED) The chemical process system of claim 7, further comprising a controller operatively coupled to a first sensor monitoring an internal pressure within the pressure vessel and a second sensor monitoring an internal pressure within the first set of isolated microchannels, wherein the controller is responsive to data generated by the first sensor and the second sensor to operate the pressure vessel at a higher pressure than the first set of isolated microchannels.

14. (PREVIOUSLY PRESENTED) The chemical process system of claim 13, wherein the controller is operatively coupled to a vent valve in fluid communication with the pressure vessel to selectively vent at least a portion of the compressive medium within the pressure vessel to decrease the internal pressure within the pressure vessel.

15. (PREVIOUSLY PRESENTED) The chemical process system of claim 13, wherein the controller is operative to detect a leak within the first set of isolated microchannels from the data generated by at least one of the first sensor and the second sensor.

16. (CANCELLED)

17. (PREVIOUSLY PRESENTED) A chemical process system comprising:

a pressure vessel having an interior;

a reactant conduit extending into the interior of the pressure vessel;

a fuel conduit extending into the interior of the pressure vessel;

an oxygen source conduit extending into the interior of the pressure vessel;

a product conduit extending into the interior of the pressure vessel;

an exhaust conduit extending into the interior of the pressure vessel;

a first microchannel module including

a first set of microchannels fluidically isolated from the interior of the pressure vessel and in communication with the reactant conduit via a reactant manifold and the product conduit via a product manifold, the first set of microchannels including a first steam reformation catalyst; and

a second set of microchannels fluidically isolated from the interior of the pressure vessel and in communication with the fuel conduit via a fluid manifold, the oxygen source conduit via an oxygen source manifold, and the exhaust conduit via an exhaust manifold, the second set of microchannels being in thermal communication with the first set of microchannels; and

a second microchannel module fluidically arranged in parallel with the first microchannel module and including

a third set of microchannels fluidically isolated from the interior of the pressure vessel and in communication with the reactant conduit via the reactant manifold and the product conduit via the product manifold, the third set of microchannels including a second steam reformation catalyst; and

a fourth set of microchannels fluidically isolated from the interior of the pressure vessel and in communication with the fuel conduit via the fuel manifold, the oxygen source conduit via the oxygen source manifold, and the exhaust conduit via the exhaust manifold, the fourth set of microchannels being in thermal communication with the third set of microchannels.

18. (PREVIOUSLY PRESENTED) The chemical process system of claim 17, wherein the second set of microchannels includes a heat exchanger.

19. (CANCELLED)

20. (PREVIOUSLY PRESENTED) The chemical process system of claim 18, wherein the heat exchanger facilitates thermal energy transfer between the second set of microchannels and the first set of microchannels.

21. (CANCELLED)

22. (PREVIOUSLY PRESENTED) The chemical process system of claim 17, further comprising a purge stream adapted to be in fluid communication with a compressive medium within the pressure vessel and in selective fluid communication with the first set of microchannels and the third set of microchannels.

23-25. (CANCELLED)

26. (PREVIOUSLY PRESENTED) The chemical process system of claim 17, wherein:

the first catalyst and the second catalyst include at least one of a catalytic lining, a catalytic pellet, and a catalytic insert.

27-28. (CANCELLED)

29. (PREVIOUSLY PRESENTED) The chemical process system of claim 17, wherein:

at least one of the microchannels of the first set of microchannels or the second set of microchannels include a catalyst in series therewith; and

the microchannels at least one of upstream of the catalyst and downstream from the catalyst comprise a heat exchanger.

30. (CANCELLED)

31. (PREVIOUSLY PRESENTED) The chemical process system of claim 17, wherein the first set of microchannels the second set of microchannels are configured in a counter-flow arrangement.

32. (PREVIOUSLY PRESENTED) The chemical process system of claim 17, further comprising a controller to regulate an internal pressure within the pressure vessel.

33. (PREVIOUSLY PRESENTED) The chemical process system of claim 17, wherein the pressure vessel includes a recycle stream for cycling a compressive medium into and out of the pressure vessel.

34-47. (CANCELLED)

48. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, wherein:

a controller operatively coupled to at least a first system sensor detecting an internal pressure within the first set of isolated microchannels and a second system sensor detecting an internal pressure within the pressure vessel, the controller being responsive to data generated by the first system sensor and the second system sensor to adjust the internal pressure within the pressure vessel.

49-52. (CANCELLED)

53. (PREVIOUSLY PRESENTED) The chemical process system of claim 48, wherein

the controller is operatively coupled to a control valve in fluid communication with a compressive medium source and upstream from the pressure vessel to selectively provide the compressive medium to the vessel and increase the internal pressure therein in response to data received from the first sensor and the second sensor; and

the pressure vessel includes an outlet stream including a vent valve in series therewith to vent excess pressurized compressive medium from the pressure vessel.

54. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, wherein the pressure vessel includes a purge valve in series therewith, operatively coupled to the controller, and in selective fluid communication with the first set of isolated microchannels.

55-56. (CANCELLED)

57. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, wherein:

the pressure vessel includes a recycle stream; and

the recycle stream is in series with at least one of a compressor, a pump, a condenser, and an external heat exchanger.

58. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, wherein the pressure vessel includes at least one refurbishment line to refurbish the catalyst in the first set of isolated microchannels.

59-60. (CANCELLED)

61. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, wherein:

at least one microchannel of the first set of isolated microchannels is adjacent to at least one microchannel of the second set of isolated microchannels and is in thermal communication therewith;

the first set of isolated microchannels includes at least one of a mixer, a chemical separation unit, and an integral heat exchanger.

62. (PREVIOUSLY PRESENTED) The chemical process system of claim 61, wherein:

the first catalyst includes at least one of a catalytic lining, a catalytic pellet, and a catalytic insert.

63. (CANCELLED)

64. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, wherein:

the pressure vessel is generally cylindrical in shape; and

the first microchannel module is generally rectangular in cross-section.

65. (CANCELLED)

66. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, wherein-the first microchannel module comprises a plurality of laminated sheets.

67. (CANCELLED)

68. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, wherein the pressure vessel includes a compressive medium including water and the pressure vessel is an elevated temperature water source.

69. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, wherein the pressure vessel includes a compressive medium and the compressive medium includes an inert medium.

70. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, wherein the first set of isolated microchannels accommodates a throughput of between 100 liters per hour to approximately 10,000 liters per hour.

71. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, further comprising a vent valve in fluid communication with the pressure vessel.

72. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, further comprising a controller operatively coupled to sensors associated with the pressure vessel and the first chemical reactor, wherein the controller is operative to maintain an internal pressure within the pressure vessel to be greater than an internal pressure within the first set of microchannels.

73. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, further comprising a purge stream providing selective fluid communication between an interior of the pressure vessel and an interior of the first set of isolated microchannels.

74. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, further comprising a recycle stream for cycling a compressive medium into and out of the pressure vessel, wherein a heat exchanger is in thermal communication with the recycle stream.

75-98. (CANCELED)

99. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, wherein the oxygen source conduit is adapted to supply air to the second set of isolated microchannels.

100-101. (CANCELED)

102. (PREVIOUSLY PRESENTED) The chemical process system of claim 17, wherein the oxygen source conduit and oxygen source manifold are adapted to supply air to the second set of microchannels and the fourth set of microchannels.

103. (PREVIOUSLY PRESENTED) The chemical process system of claim 1, wherein the first set of isolated microchannels and the second set of isolated microchannels include an arrangement of repeating units.

104. (PREVIOUSLY PRESENTED) The chemical process system of claim 103, wherein one of the repeating units includes

a reactant microchannel and a product microchannel of the first set of isolated microchannels, and

a fuel microchannel, an oxygen source microchannel, and a product microchannel of the second set of isolated microchannels; and

wherein the reactant microchannel of the first set of isolated microchannels is adjacent the fuel microchannel of the second set of isolated microchannels.

105. (PREVIOUSLY PRESENTED) The chemical process system of claim 104, wherein the oxygen source microchannel interposes the fuel microchannel and the product microchannel of the second set of isolated microchannels.

106. (PREVIOUSLY PRESENTED) The chemical process system of claim 105, wherein the repeating unit includes

two reactant microchannels of the first set of isolated microchannels interposed by the product microchannel of the first set of isolated microchannels,

two oxygen source microchannels of the second set of isolated microchannels interposed by the product microchannel of the second set of isolated microchannels, and

two fuel microchannels of the second set of isolated microchannels interposed by the two oxygen source microchannels of the second set of isolated microchannels and the product microchannel of the second set of isolated microchannels.

107. (PREVIOUSLY PRESENTED) The chemical process system of claim 17, wherein the first set of microchannels and the second set of microchannels include an arrangement of repeating units.

108. (PREVIOUSLY PRESENTED) The chemical process system of claim 107, wherein one of the repeating units includes

a reactant microchannel and a product microchannel of the first set of microchannels, and

a fuel microchannel, an oxygen source microchannel, and a product microchannel of the second set of microchannels; and

wherein the reactant microchannel of the first set of microchannels is adjacent the fuel microchannel of the second set of microchannels.

109. (PREVIOUSLY PRESENTED) The chemical process system of claim 108, wherein the oxygen source microchannel interposes the fuel microchannel and the product microchannel of the second set of microchannels.

110. (PREVIOUSLY PRESENTED) The chemical process system of claim 109, wherein the repeating unit includes

two reactant microchannels of the first set of microchannels interposed by the product microchannel of the first set of microchannels,

two oxygen source microchannels of the second set of microchannels interposed by the product microchannel of the second set of microchannels, and

two fuel microchannels of the second set of microchannels interposed by the two oxygen source microchannels of the second set of microchannels and the product microchannel of the second set of microchannels.